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EXAMINER	
ALEXANDER, MICHAEL P	
ART UNIT	**PAPER NUMBER**
1742	

DATE MAILED: 07/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/608,404	LIU ET AL.	
	Examiner	Art Unit	
	Michael P. Alexander	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-8,10-15 and 18-31* is/are rejected.

7)☐ Claim(s) *9,16-17 and 32-36* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *See Other*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: *See Continuation Sheet*.

Continuation of Attachment(s) 6). Other: 8/22/03, 2/9/04, 3/19/04, 4/22/04, 4/22/04, 4/26/04, 10/15/04 and 1/18/05.

DETAILED ACTION

Priority

Applicant's claim for domestic priority under 35 U.S.C. 119(e) is acknowledged. However, the provisional application upon which priority is claimed fails to provide adequate support under 35 U.S.C. 112 for claims 1-36 of this application. Applications 10/038,066 and 10/032,275 do not disclose removing conductive material disposed over narrow feature definitions at a higher removal rate than conductive material disposed over wide feature definitions.

Claim Interpretations

The Examiner would like to set forth his interpretations of the terms "chemical mechanical polishing" and "electrochemical mechanical polishing" in claims 11-17, 26-32 and 35. Pages 7-8 of the specification of the instant application set forth how the applicant prefers that the terms be construed. However, the Examiner asserts that "chemical mechanical polishing" must include both a chemical element and a mechanical element and that "electrochemical mechanical polishing" must include both an electrochemical element and a mechanical element. Otherwise would be repugnant to their ordinary meanings and would make the claim scope difficult to comprehend.

The Examiner would like to set forth his interpretations of claim 18. The applicant introduces "a substrate having a conductive material layer disposed thereon" in line 1 and refers to "the conductive material layer" in line 5 and "the conductive material" in line 10. However, applicant refers only to "conductive material" in line 9.

The Examiner will interpret that all references are to the conductive material disposed on the substrate.

Claim Objections

Claim 6 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 1 includes the limitation **by weight** of one or more corrosion inhibitors in line 11. Claim 6 includes the limitation **by volume or weight** of the one or more corrosion inhibitors in line 2. Therefore claim 6 expands the scope of claim 1.

Claim 18 is objected to because of the following informalities: "conductive material" in line 9 should read – the conductive material--. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 18-21, 23, 26 and 28-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Hongo et al. (U.S. Pat. Pub. 2004/0154931).

Regarding claim 18, Hongo et al. teach (see Figs. 4 and 17 and paragraphs 0014-0026) a method of processing a substrate having a conductive material layer disposed thereon, comprising: providing the substrate to a process apparatus comprising a first electrode and a second electrode with the substrate in electrical contact with the second electrode, wherein the conductive material layer is disposed over narrow feature definitions and wide feature definitions; supplying a polishing composition between the first electrode and the substrate, wherein the polishing composition forms a copper-oxine film on exposed conductive material; abraiding the passivation layer to expose a portion of the conductive material; and applying power by a pulse modulation technique between the first electrode and the second electrode to remove conductive material.

Still regarding claim 18, Hongo et al. do not specify "removing conductive material disposed over narrow feature definitions at a higher removal rate than conductive material over wide feature definitions." However, Hongo et al. teach applying the method to planarize the surface in Fig. 17, which has more conductive material disposed over narrow feature definitions than over wide feature definitions. Therefore, in the process of planarizing that surface, the method of Hongo et al. would inherently remove conductive material disposed over narrow feature definitions at a higher removal rate than conductive materials over wide feature definitions.

Regarding claim 19, Hongo et al. do not teach that the pulse technique forms a protrusion of conductive material over a wide feature definition. However, a "protrusion" of at least microscopic or atomic proportions would inherently form over one of the wide

feature definitions at some point in time during the electropolishing process of Hongo et al. as a normal variation in surface roughness. Therefore, the pulse technique would inherently be adapted to form such protrusion.

Regarding claim 20, Hongo et al. teach (paragraph 0026) that the current may be a pulse current.

Regarding claim 21, Hongo et al. teach (paragraph 0019) applying an electrolytic current of 0.1 mA/cm^2.

Regarding claim 23, Hongo et al. teach (paragraph 0117) applying a pulse with a repetition of 10 mS on and 10 mS off, which would correspond to a duty cycle of 50%.

Regarding claims 26 and 28-29, Hongo et al. teach (paragraphs 0130, 134 and 135) that the method can further comprise polishing the substrate by a second electrochemical mechanical polishing process on a second platen.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 24-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. as applied to claim 18 above, and further in view of Mayer et al. (U.S. Pat. 6,315,883).

Regarding claim 24, Hongo et al. (paragraphs 0016-0022) teach supplying a polishing composition between the first electrode and the substrate, wherein the polishing composition comprises phosphoric acid (paragraphs 0016-0017), chelating agent hydroxyquinoline (paragraph 0018), 0.001 to 0.5% corrosion inhibitor benzotriazole, and a solvent, wherein the polishing composition forms a oxine-copper film formed in the copper surface. Hongo et al. do not specify that the composition can also comprise "one or more inorganic or organic acid salts" and "one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7."

With respect to the limitation of "one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7" in claim 24, the phosphoric acid also qualifies as a pH adjusting agent. Also, Hongo et al. teach (paragraph 0022) that the pH of the polishing liquid can be in the range of 5-9 to ensure that the oxine-copper film can grow evenly. The pH 4.5-7.0 portion of the pH 5-9 reads on the limitation in claim 24.

With respect to the limitation of "one or more inorganic or organic acid salts" in claim 24, Mayer et al. (U.S. Pat. 6,315,883) teach (col. 11 lines 38-55) the addition of copper sulfate in order to avoid generation of bubbles from the electrolysis of the electrolyte at the counter electrode and thereby positively impact the quality of the

electropolished film at the substrate. It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to add copper sulfate to the solution of Hongo et al. in order to avoid generation of bubbles at the counter electrode as taught by Mayer et al.

Regarding claim 25, Hongo et al. teach (paragraphs 0015-0025) applying a pressure between the substrate and a polishing article and providing relative motion between the substrate and the polishing article, but do not specify applying a contact pressure between about 0.01 psi and about 1 psi. However, Hongo et al. do teach (paragraphs 0008-0025) that the use of a high polishing pressure tends to cause scratches, dishing, erosion, recesses, etc. in the surface and but that the polishing method of Hongo et al. provides for an oxine-copper film that can easily be polished away at a low pressure. Since the polishing pressure is a result-effective variable as taught by Hongo et al., it would have been obvious to one of ordinary skill in the art to polish at the desired pressure by routine optimization.

Claims 1-8, 10-11 and 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hongo et al. in view of Mayer et al. (U.S. Pat. 6,315,883).

Regarding claim 1, Hongo et al. (see Figs. 4 and 17 and paragraphs 0016-0024) teach a method of processing a substrate having a conductive material layer disposed thereon, comprising: providing the substrate to a process apparatus comprising a first electrode and a second electrode with the substrate in electrical contact with the second electrode, wherein the substrate surface comprises conductive material layer disposed over narrow feature definitions and wide feature definitions; supplying a polishing

composition between the first electrode and the substrate, wherein the polishing composition comprises phosphoric acid (paragraphs 0016-0017), chelating agent hydroxyquinoline (paragraph 0018), 0.001 to 0.5% corrosion inhibitor benzotriazole, and a solvent, wherein the polishing composition forms a oxine-copper film formed in the copper surface, abraiding the oxine-copper film to expose a portion of the conductive material (paragraph 0024); and applying a bias between the first electrode and the second electrode.

Still regarding claim 1, Hongo et al. do not specify that the composition can also comprise “one or more inorganic or organic acid salts” and “one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7.” Hongo et al. also do not specify “removing conductive material disposed over narrow feature definitions at a higher removal rate than conductive material over wide feature definitions.”

With respect to the limitation of “one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7” in claim 1, the phosphoric acid qualifies as a pH adjusting agent. Also, Hongo et al. teach (paragraph 0022) that the pH of the polishing liquid can be in the range of 5-9 to ensure that the oxine-copper film can grow evenly. The pH 4.5-7.0 portion of the pH 5-9 reads on the limitation in claim 1.

With respect to the limitation of “removing conductive material disposed over narrow feature definitions at a higher removal rate than conductive materials over wide feature definitions” in claim 1, Hongo et al. teach applying the method to planarize the surface in Fig. 17, which has more conductive material disposed over narrow feature definitions than over wide feature definitions. Therefore, in the process of planarizing

that surface, the method of Hongo et al. must remove conductive material disposed over narrow feature definitions at a higher removal rate than conductive materials over wide feature definitions.

With respect to the limitation of "one or more inorganic or organic acid salts" in claim 1, Mayer et al. (U.S. Pat. 6,315,883) teach (col. 11 lines 38-55) the addition of copper sulfate in order to avoid generation of bubbles from the electrolysis of the electrolyte at the counter electrode and thereby positively impact the quality of the electropolished film at the substrate. It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to add copper sulfate to the solution of Hongo et al. in order to avoid generation of bubbles at the counter electrode as taught by Mayer et al.

Regarding claim 2, Hongo et al. do not specify forming a protrusion of conductive material over the wide feature definitions. However, a "protrusion" of at least microscopic or atomic proportions would form over one of the wide feature definitions at some point in time during the electropolishing process of Hongo et al. as a normal expected variation.

Regarding claim 3, Hongo et al. teach (paragraph 0019) applying an electrolytic current of 0.1 mA/cm^2.

Regarding claim 4, Hongo et al. teach (paragraph 0026) that the current may be a pulse current.

Regarding claim 5, Hongo et al. do not teach adjusting the composition and pulse technique to form a protrusion of conductive material over a wide feature definition.

However, a "protrusion" of at least microscopic or atomic proportions would inherently form over one of the wide feature definitions at some point in time during the electropolishing process of Hongo et al. as a normal expected variation. Therefore, the composition and pulse technique would be adapted to form such protrustion.

Regarding claim 6, Hongo et al. teach (paragraph 0021) that the corrosion inhibitors comprising 0.001 to 0.5 % by weight. The portion of the range of from 0.2 to 0.5 % by weight anticipates the claimed range.

Regarding claim 7, the very small protrusions would be less than 50% of a thickness of a deposited conductive material.

Regarding claim 8, Hongo et al. teach (paragraphs 0016-0022) that the composition can further comprise: between 0.01 to 5.0 mol/L of phosphoric acid and preferably between 0.05 to 0.2% by weight chelating agent hydroxyquinoline. The phosphoric acid also qualifies as a pH-adjusting agent, and the pH of the polishing liquid would be in the range of 5-9 to ensure that the oxine-copper film can grow evenly. The pH 4.5-7 portion of the pH 5-9 would read on the pH limitation in claim 8. Hongo et al. do not specify that the composition can further comprise " between about 0.1% and about 15% by volume or weight of the one or more inorganic or organic acid salts in the total volume of solution."

However, Mayer et al. (U.S. Pat. 6,315,883) teach (col. 11 lines 38-55) the addition of copper sulfate in order to avoid generation of bubbles from the electrolysis of the electrolyte at the counter electrode and thereby positively impact the quality of the electropolished film at the substrate. Since the amount of copper sulfate is a result-

effective variable as taught by Mayer et al., it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to add the desired amount of copper sulfate to the solution of Hongo et al. by routine optimization. See MPEP 2144.05 II.

Regarding claim 10, Hongo et al. teach (paragraphs 0015-0025) applying a pressure between the substrate and a polishing article and providing relative motion between the substrate and the polishing article, but do not specify applying a contact pressure between about 0.01 psi and about 1 psi. However, Hongo et al. do teach (0008-0025) that the use of a high polishing pressure tends to cause scratches, dishing, erosion, recesses, etc. in the surface and but that the polishing method of Hongo et al. provides for an oxine-copper film that can easily be polished away at a low pressure. Since the polishing pressure is a result-effective variable as taught by Hongo et al., it would have been obvious to one of ordinary skill in the art to polish at the desired pressure by routine optimization.

Regarding claim 11 and 13-15, Hongo et al. teach (paragraphs 0130, 134 and 135) that the method can further comprise polishing the substrate by a second electrochemical mechanical polishing process on a second platen.

Claims 1-2, 6-7, 10-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Emesh et al. (U.S. Pat. 6,736,952) in view of Yang et al. and further in view of Mayer et al. (U.S. Pat. 6,315,883).

Regarding claim 1, Emesh et al. teach (Figs. 2-4 and cols. 9 -10) a method of processing a substrate having a conductive material layer disposed thereon,

comprising: providing the substrate to a process apparatus comprising a first electrode and a second electrode with the substrate in electrical contact with the second electrode, wherein the substrate surface comprises conductive material layer disposed over narrow feature definitions and wide feature definitions; supplying a polishing composition comprising: phosphoric acid, chelating agents, benzotriazole, copper sulfate and a solvent, wherein the polishing composition forms a passivation layer on the conductive material; abraiding the passivation layer to expose a portion of the conductive material; applying a bias between the first electrode and the second electrode; and removing conductive material over the narrow feature definitions and wide feature definitions.

Still regarding claim 1, Emesh et al. do not specify that the benzotriazole would be greater than about 0.2% by weight and do not specify adding one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7. Emesh et al. also do not specify that the conductive material over the narrow feature definitions would be removed at a higher rate than the conductive material over the wide feature definitions.

With respect to the claim limitation that benzotriazole would be greater than about 0.2% by weight in claim 1, Emesh et al. teach (col. 5 line 53- col. 6 line 9) that benzotriazole facilitates the formation of a passivation film on the metal, which enhances uniform planarization. Since the amount of benzotriazole is a result-effective variable as taught by Emesh et al., it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to add the desired amount of benzotriazole to

the polishing composition of Emesh et al. as a routine optimization. See MPEP 2144.05 II.

With respect to the claim limitation of adding one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7 in claim 1. Emesh et al. teach (see Fig. 5 and col. 5 lines 39-52) adding acids, which would adjust pH, but not that the pH would be between greater than about 4.5 and about 7. However, Yang et al. teach (col. 3 lines 37-53) that pH affects increases the etching rate. Since pH is a result-effective variable as taught by Yang et al., it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to adjust the pH to the desired amount as a routine optimization. See MPEP 2144.05 II.

With respect to the claim limitation that conductive material over the narrow feature definitions would be removed at a higher rate than the conductive material over wide feature definitions in claim 1, Emesh et al. do not teach applying the method to a substrate containing more material over narrow feature definitions than over wide feature definitions. Mayer et al. discloses (see abstract and Fig. 3) forming a substrate containing more material over narrow feature definitions than over wide feature definitions and applying the planarization method of Mayer et al. in order to planarize the substrate. It would have been obvious to one of ordinary skill in the art to combine the planarizing method of Emesh et al. with the substrate of Mayer et al. in order to planarize the substrate as taught by Mayer et al. As applied, conductive material over narrow features would be removed at a higher rate than conductive material over wide features.

Regarding claim 2, Emesh et al. do not specify forming a protrusion of conductive material over the wide feature definitions. However, a "protrusion" of at least microscopic or atomic proportions would form over one of the wide feature definitions at some point in time during the electropolishing process of Hongo et al. as a normal expected variation.

Regarding claim 6, Emesh et al. do not specify that the benzotriazole would comprise between greater than about 0.2% and about 1.0% by volume or weight of the composition. However, Emesh et al. teach (col. 5 line 53- col. 6 line 9) that benzotriazole facilitates the formation of a passivation film on the metal, which enhances uniform planarization. Since the amount of benzotriazole is a result-effective variable as taught by Emesh et al., it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to add the desired amount of benzotriazole to the polishing composition of Emesh et al. as a routine optimization. See MPEP 2144.05 II.

Regarding claim 7, the very small protrusions would be less than 50% of a thickness of a deposited conductive material.

Regarding claim 10, Emesh et al. teach (col. 9 lines 26-43) applying a contact pressure of approximately 1 psi or less and providing relative motion between the substrate and the polishing article.

Regarding claim 11, Emesh et al. teach (col. 10 lines 32-45) applying an additional chemical mechanical polishing process.

Regarding claim 12, Emesh et al. teach (col. 2 lines 30-39) that chemical mechanical polishing causes dishing in the center of wide metal features.

Regarding claim 14, Emesh et al. teach (col. 10 lines 32-45) applying an additional electrochemical mechanical polishing process.

Claims 18-20, 25-27 and 29-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Emesh et al. (U.S. Pat. 6,736,952 B2) in view of Mayer et al. (U.S. Pat. 6,315,883).

Regarding claim 18, Emesh et al. teach (see Figs. 2-4 and cols. 9-10) a method of processing a substrate having a conductive material layer disposed thereon, comprising: providing the substrate to a process apparatus comprising a first electrode and a second electrode with the substrate in electrical contact with the second electrode, wherein the substrate surface comprises conductive material layer disposed over narrow feature definitions and wide feature definitions; supplying a polishing composition between the first electrode and the substrate, wherein the polishing composition forms a passivation layer on the conductive material; abraiding the passivation layer to expose a portion of the conductive material; applying power by a pulse modulation technique between the first electrode and the second electrode; and removing conductive material over the narrow feature definitions and wide feature definitions. Emesh et al. do not specify that the conductive material over the narrow feature definitions would be removed at a higher rate than the conductive material over the wide feature definitions.

With respect to the claim limitation that conductive material over the narrow feature definitions would be removed at a higher rate than the conductive material over wide feature definitions in claim 18, Emesh et al. do not teach applying the method to a substrate containing more material over narrow feature definitions than over wide feature definitions. Mayer et al. discloses (see abstract and Fig. 3) forming a substrate containing more material over narrow feature definitions than over wide feature definitions and applying the planarization method of Mayer et al. in order to planarize the substrate. It would have been obvious to one of ordinary skill in the art to combine the planarizing method of Emesh et al. with the substrate of Mayer et al. in order to planarize the substrate as taught by Mayer et al. As applied, conductive material over narrow features would be removed at a higher rate than conductive material over wide features.

Regarding claim 19, the very small protrusions would be less than 50% of a thickness of a deposited conductive material.

Regarding claim 20, Emesh et al. teach (col. 9 lines 44-65) that the current or voltage can be modulated.

Regarding claim 25, Emesh et al. teach (col. 9 lines 26-43) applying a contact pressure of approximately 1 psi or less and providing relative motion between the substrate and the polishing article.

Regarding claim 26, Emesh et al. teach (col. 10 lines 32-45) applying an additional chemical mechanical polishing process.

Regarding claim 27, Emesh et.al. teach (col. 2 lines 30-39) that chemical mechanical polishing causes dishing in the center of wide metal features.

Regarding claim 29, Emesh et al. teach (col. 10 lines 32-45) applying an additional electrochemical mechanical polishing process.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Emesh et al. in view of Mayer et al. as applied to claim 20 above, and further in view of Kohl et al. (U.S. Pat. 4,369,099).

Regarding claim 22, Emesh et al. do not specify applying a power between about 2 seconds and about 25 seconds and not applying a power between about 2 seconds and about 25 seconds. However, Kohl et al. teach (col. 4 lines 9-26) that short times are wasteful of power and long times reduce etch rate. Since pulse duration is a result-effective variable as taught by Kohl et al., it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to set the pulse duration to the desired amount as a routine optimization. See MPEP 2144.05 II.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Emesh et al. in view of Mayer et al. as applied to claim 18 above, and further in view of Yang et al. (U.S. Pat. 6,596,152).

Regarding claim 24, Emesh et al. teach (cols. 9-10) supplying a polishing composition comprising: phosphoric acid, chelating agents, benzotriazole, copper sulfate and a solvent. Emesh et al. do not specify that the benzotriazole would be greater than about 0.2% by weight and do not specify adding one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7.

With respect to the claim limitation that benzotriazole would be greater than about 0.2% by weight in claim 24, Emesh et al. teach (col. 5 line 53- col. 6 line 9) that benzotriazole facilitates the formation of a passivation film on the metal, which enhances uniform planarization. Since the amount of benzotriazole is a result-effective variable as taught by Emesh et al., it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to add the desired amount of benzotriazole to the polishing composition of Emesh et al. as a routine optimization. See MPEP 2144.05 II.

With respect to the claim limitation of adding one or more pH adjusting agents to provide a pH between greater than about 4.5 and about 7 in claim 24. Emesh et al. teach (see Fig. 5 and col. 5 lines 39-52) adding acids, which would adjust pH, but not that the pH would be between greater than about 4.5 and about 7. However, Yang et al. teach (col. 3 lines 37-53) that pH affects increases the etching rate. Since pH is a result-effective variable as taught by Yang et al., it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to adjust the pH to the desired amount as a routine optimization. See MPEP 2144.05 II.

Claims 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang et al. (U.S. Pat. 6,447,668) in view of Mayer et al. (U.S. Pat. 6,315,883 B1) and in view of the admission of the background section of parent application (U.S. Pat. 6,811,680 B2).

Regarding claims 30-31, Wang et al. disclose (see Fig. 1 and abstract) a method of processing a substrate having conductive material layer disposed thereon over

narrow feature definitions and wide feature definitions comprising removing conductive material disposed over narrow feature definitions and wide feature definitions by electrochemical mechanical polishing. Wang et al. do not specify that during part of the electrochemical mechanical polishing conductive material the conductive material disposed over narrow feature definitions would be removed at a higher rate than the conductive material disposed over wide feature definitions and that during another part of the electrochemical mechanical polishing the conductive material disposed over wide feature definitions would be removed at a higher rate than the conductive material disposed over narrow feature definitions.

With respect to the claim limitation that conductive material over the narrow feature definitions would be removed at a higher rate than the conductive material over wide feature definitions in claims 30-31, Wang et al. do not teach applying the method to a substrate containing more material over narrow feature definitions than over wide feature definitions. Mayer et al. discloses (see abstract and Fig. 3) forming a substrate containing more material over narrow feature definitions than over wide feature definitions and applying the planarization method of Mayer et al. in order to planarize the substrate. It would have been obvious to one of ordinary skill in the art to combine the planarizing method of Wang et al. with the substrate of Mayer et al. in order to planarize the substrate as taught by Mayer et al.

With respect to the limitation of removing conductive material disposed over wide feature definitions at a higher rate than conductive material disposed over narrow feature definitions during chemical mechanical polishing in claims 30-31, the Examiner

asserts that it is well known that overpolishing causes dishing. As evidence see the admission in the background section of parent application (U.S. Pat. 6,811,680 B2) col. 2 lines 46-56 which states that overpolishing causes dishing. The Examiner asserts that in dishing the amount of material disposed over wide feature definitions would be removed at a higher rate than conductive material disposed over narrow feature definitions. Wang et al. teaches (see abstract) a method of endpoint detection to avoid overpolishing. Therefore, Wang et al. discloses overpolishing the wafer, which would lead to dishing, which results in the material disposed over wide feature definitions being removed at a higher rate than material over narrow features.

Allowable Subject Matter

Claims 9, 16-17 and 32-36 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 9, the prior art does not disclose a polishing solution with the composition of claim 9 and with a pH of between about 4.5 and about 7 for use in electrochemical mechanical polishing. Applicant teaches that the composition is used in the method to produce protrusions over wide features during electrochemical mechanical polishing in order to eliminate dishing.

Regarding claim 16-17, the prior art does not disclose a first electrochemical mechanical polishing step having a first concentration of inhibitor and a second

electrochemical mechanical step having a second concentration of inhibitor less than the first concentration of inhibitor combined with the other claim limitations of claim 16.

Regarding claims 32-34, the prior art does not disclose: a first electrochemical mechanical polishing step having a first concentration of inhibitor that removes conductive material over narrow features at a higher rate than over wide features; and a second electrochemical mechanical step having a second concentration of inhibitor less than the first concentration of inhibitor that removes conductive material over wide features at a higher rate than over narrow features.

Regarding claims 35-36, the prior art does not disclose: a first electrochemical mechanical polishing step having a first pH that removes conductive material over narrow features at a higher rate than over wide features; and a second electrochemical mechanical step having a second pH less than the first pH that removes conductive material over wide features at a higher rate than over narrow features.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael P. Alexander whose telephone number is 571-272-8558. The examiner can normally be reached on M-F 8:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V. King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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